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NOTES: Lewis dot diagrams, Ionic and Covalent Bonding

1. Review

An atom that gains one or more electrons will have a NEGATIVE charge.

An atom that loses one or more electrons will have a POSITIVE charge.

An atom that gains or loses one or more electrons is called an ION.

The outermost electron shell is also known as the VALANCE SHELL

2. Lewis Dot Diagrams → THE GOAL IS TO BE HAPPY

1. FIGURE OUT THE # OF VALANCE ELECTRONS EACH ATOM HAS
2. DRAW THE ELECTRONS AS DOTS ONE AT A TIME AROUND THE ELEMENT SYMBOL IN A CLOCKWISE FASHION STARTING AT THE TOP
3. AFTER ONE e⁻ IS ON EACH SIDE - DOUBLE THEM UP UNTIL YOU RUN OUT OF e⁻

EX: Na Cl → SODIUM HAS 1 VALANCE e⁻ THAT IT WANTS TO GET RID OF - CHLORINE NEEDS ONE VALANCE e⁻

Na → Cl: [Na]⁺ [:Cl:]⁻

3. What is an ionic bond?

TO BE HAPPY AN ATOM NEEDS A FULL VALANCE SHELL

Atoms will transfer one or more ELECTRONS to another to form the bond.

Each atom is left with a FULL outer shell.

A positive ion is called a CATION and a negative ion is called an ANION.

An ionic bond forms between a METAL ion with a positive charge and a NON METAL ion with a negative charge.

Metal always comes first!!

Ionic bond practice using Lewis dot diagrams

Example 1: Potassium + Bromine

KBr K → Br: [K]⁺ [:Br:]⁻

DRAW ARROWS SHOWING HOW e⁻ ARE DONATED/ ACCEPTED... THEN DRAW A PICTURE SHOWING THE FINAL POSITION OF THE e⁻ AND THE RESULTING CHARGE.

Example 2: Lithium + Oxygen

Li_2O Li → O: [Li]⁺ [:O:]²⁻ [Li]⁺

Li

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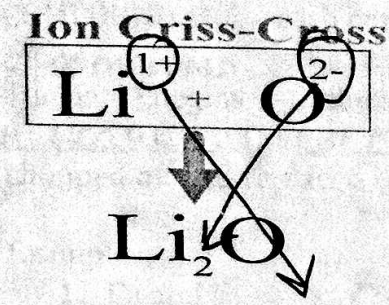
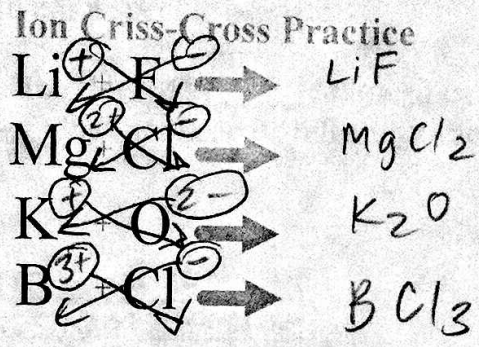
4. Writing a formula using the criss-cross method for ionic bonds:





(IF ONE – DO NOT WRITE)

4a. SUBSCRIPTS show the number of atoms present of a certain element in molecule or compound

H_2O

# of H= 2
# of O= 1

$Li(OH)_2$

# of Li 1
# of OH 2

OF O 2 — # OF H 2

4b. A **Polyatomic ion** is: A group of atoms that acts like an ion

To write the formulas if there is more than one of these groups one must use PARENTHESIS

Al^{3+} NO_3^- → $Al(NO_3)_3$

Ex: Al and NO_3

They can be found on the back of your periodic table, when naming them use the names found there... or here!!

+2	-1	-2
Hg_2^{2+} mercury (I) or mercurous	$C_2H_3O_2^-$ acetate	CO_3^{2-} carbonate
	ClO_3^- chlorate	CrO_4^{2-} chromate
	ClO_2^- chlorite	$Cr_2O_7^{2-}$ dichromate
	CN^- cyanide	HPO_4^{2-} hydrogen phosphate
	$H_2PO_4^-$ dihydrogen phosphate	O_2^{2-} peroxide
	HCO_3^- hydrogen carbonate (bicarbonate)	SO_4^{2-} sulfate
+1	HSO_4^- hydrogen sulfate (bisulfate)	SO_3^{2-} sulfite
NH_4^+ ammonium	OH^- hydroxide	$S_2O_3^{2-}$ thiosulfate
H_3O^+ hydronium	ClO^- hypochlorite	
	NO_3^- nitrate	
	NO_2^- nitrite	
	ClO_4^- perchlorate	-3
	MnO_4^- permanganate	PO_4^{3-} phosphate

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5.Naming compounds

When two atoms of a different element come together we call that a COMPOUND..... each compound has a specific name.....

IONIC COMPOUND

The name begins with the name of the METAL followed by the name of the NON-METAL. The NON-METAL does not keep its full name, the ending is chopped off and replaced by "-ide"

Examples:

1. Ca and I — CALCIUM IODIDE
2. Mg and O — MAGNESIUM OXIDE
3. Na and S — SODIUM SULFIDE

5a. Many transition metals have more than one OXIDATION NUMBER/STATE

Indicate the particular oxidation by using PARENTHESIS

Ex. Fe_2O_3 — IRON (III) OXIDE

versus: FeO — IRON (II) OXIDE

DO THE REVERSE ION CRISS CROSS TO FIND OXIDATION #

IF 1:1 RATIO FIND NON METALS CHARGE

Fe O^{2-} IF OXYGEN IS 2- IRON MUST BE 2+

5b. Polyatomic ions and naming:

NAMES SHOULD END IN –ATE OR –ITE AND INFREQUENTLY IT WILL REMAIN –IDE (CYANIDE AND HYDROXIDE)

Examples:

$Ca(OH)_2$ — CALCIUM HYDROXIDE

$CuSO_4$ — COPPER SULFATE

NH_4NO_3 — AMMONIUM NITRATE

$Co_2(CO_3)_3$ — COBALT CARBONATE

6. What is a covalent bond

Atoms SHARE one or more electrons with each other to form the bond.

Each atom is left with a FULL outer shell.

A covalent bond forms between two NON-METALS.

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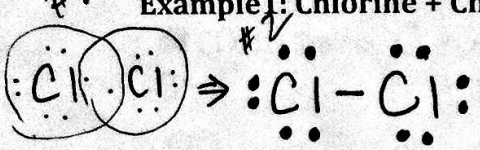
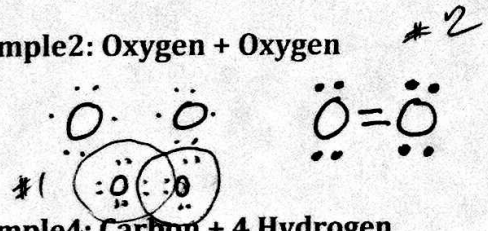
Use Lewis dot diagrams to draw the following covalent bonds:

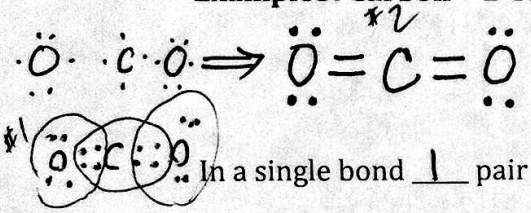
Example1: Chlorine + Chlorine



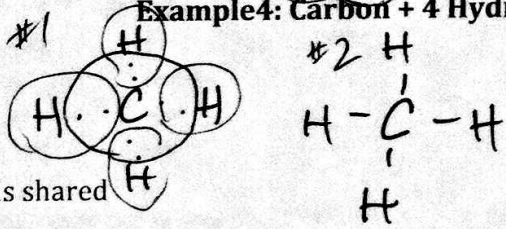
Example2: Oxygen + Oxygen



Example3: Carbon + 2 Oxygen



Example4: Carbon + 4 Hydrogen



In a single bond 1 pair of electrons is shared

In a double bond 2 pair of electrons are shared

7. Characteristics of Bonds:

Characteristics of:	
Ionic compounds	**Covalent compounds**
1. Hard	1. Solid, Liquid or gas
2. MOSTLY SOLID AT ROOM TEMP	2. LOW MELTING/BOILING POINT
3. High melting point	3. Flammable
4. BRITTLE	4. DO NOT CONDUCT ELECTRICITY
5. Only conduct electricity when melted	5. Do not dissolve in water
6.	